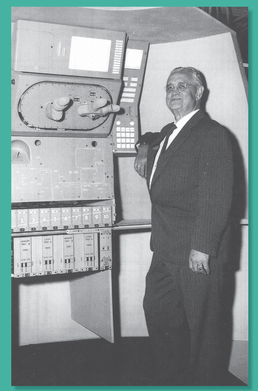
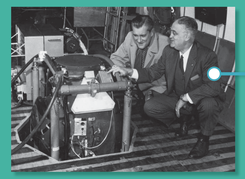
Hangar 24, C.S. Draper, and the Massachusetts Tech Belt

Laurence G. Hanscom Field and adjacent Hanscom Air Force Base participated in the United States' World War II and Cold War national defense activities and the development of Massachusetts' economy. Hangar 24, formerly the Massachusetts Institute of Technology Instrumentation Laboratory Flight Facility, was a key site where scientists and engineers tested groundbreaking innovations between 1948 and 2001.

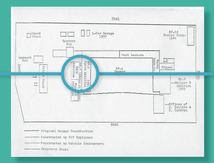


Charles Stark Draper inspects a mock-up of the Apollo guidance and control system, September 1963.[1]



Charles Stark Draper (right) explains the SPIRE system to CBS news reporter Eric Severeid in the aircraft.[2]

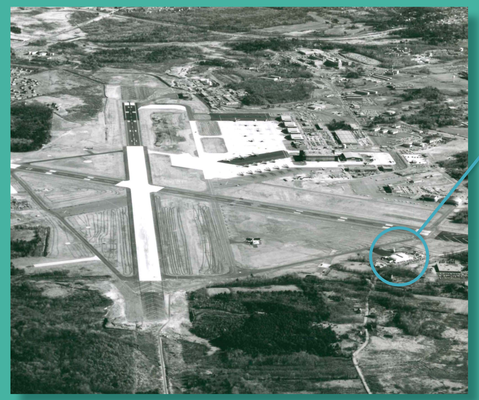
SPIRE guidance system being loaded onto a test aircraft outside Hangar 24 in 1953. The aircraft then traveled from Hanscom Field to Los Angeles, California, in the world's first unpiloted transcontinental flight. CBS reporter Eric Severeid documented the historic occasion.[3]



Hangar 24 was a critical test site for the development of Instrumentation Lab technologies. This 1975 site plan illustrates the numerous additions to the facility needed for the Lab's projects.[4]

In this historic telegram, US Senator Leverett Saltonstall of Massachusetts notified Charles Stark Draper that NASA had selected his lab to develop the navigation system for the Apollo moon missions.[5]

Launch of Apollo 8 from Cape Canaveral, Florida, December 21, 1968. The Instrumentation Lab provided essential technology for the moon missions.[6]



Hanscom Field, circa 1960, looking east. Hangar 24 is at lower right, and Route 128 runs along the top of the image.[7]

Hangar 24 and test aircraft at Hanscom Field in 1948, showing the arched truss across the hangar roof, which was added by the Instrumentation Lab that same year.[8]

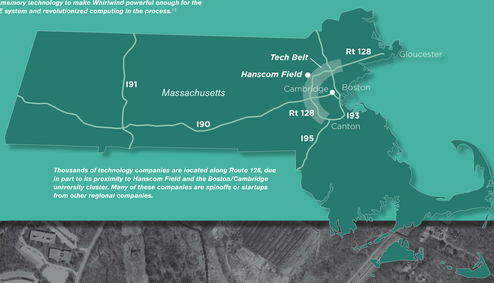
Sign on Hangar 24 showing the name of the facility after 1970.[11]

Final configuration of Hangar 24, with additions for Instrumentation Lab projects. By the early 2000s, the hangar was too small to accommodate modern test aircraft (as evidenced by the projecting aircraft tail) and could no longer act as an effective research and testing facility.

Hangar 24 in 2012.[12]

MIT Lincoln Laboratory's Whirlwind, seen here in 1950, the first high-speed, digital mainframe computer operating in real time and using a video display for output. Jay Forrester of MIT invented magnetic core memory technology to make Whirlwind powerful enough for the SAGE system and revolutionized computing in the process.[13]

Road signs along Route 128 once proudly advertised the region's technology-based economy, as shown in this 1987 photograph.[14]



Thousands of technology companies are located along Route 128, due in part to its proximity to Hanscom Field and the Boston/Cambridge university cluster. Many of these companies are spinoffs or startups from other regional companies.

[1] Image courtesy of National Academy of Engineering.
[2] Image courtesy of MIT Museum.
[3] Image courtesy of MIT Museum.
[4] Image courtesy of MIT Museum. Reprinted with permission of MIT Lincoln Laboratory, Lexington, Massachusetts.
[5] Image courtesy of MIT Archives.
[6] Image courtesy of NASA.
[7] Image courtesy of US Air Force, 66th Air Base Group History Office. Reprinted with permission of MIT Lincoln Laboratory, Lexington, Massachusetts.
[8] "The Public Archaeology Laboratory, Inc.
[11] "The Public Archaeology Laboratory, Inc.
[12] "The Public Archaeology Laboratory, Inc.
[13] Image courtesy of MIT Museum.
[14] "Massachusetts Route 128." Massachusetts Institute of Technology, photo by Lois A. Craig, 1987. Licensed under Creative Commons License 3.0.

1901 Charles Stark Draper born in Windsor, Missouri

1940 Hanscom Field (then Boston Auxiliary Airport) established by Commonwealth of Massachusetts

1946 Beginning of the Cold War

1950 Air Force Cambridge Research Laboratory permanently located at Hanscom Field

1974 Massachusetts Port Authority assumes responsibility for general operations and maintenance of Hanscom Field

1989 End of the Cold War

2001 MIT ends testing activities at Hangar 24

2012 Hangar 24 dismantled

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

1932 Instrumentation Laboratory established by Charles Stark Draper at MIT

1948 MIT Instrumentation Laboratory moves Hangar 24 from Georgia to Hanscom Field

1951 MIT Lincoln Laboratory established and Route 128 opens

1978 Lincoln Lab takes over Hangar 24

hanscom field massport

Charles Stark "Doc" Draper 1901–1987

Charles Stark Draper, known as the "father of inertial navigation," was a significant American aeronautical engineer and educator. Draper was born in 1901 in Windsor, Missouri. In 1922, he graduated from Stanford University with a Bachelor's degree in Psychology. That same year, he visited the MIT campus in Cambridge, Massachusetts, and became interested in aeronautical engineering. He enrolled at MIT and earned a bachelor's degree in electromechanical engineering in 1926 and a doctoral degree in physics in 1938. Draper established the Instrumentation Laboratory (Instrumentation Lab) in 1932 while a research associate in aeronautical engineering at the university.

Draper's nearly 45-year career at MIT and the Instrumentation Lab illustrates the intersection of academic pursuits and business and military interests prevalent in the mid-20th century. He and his team developed inertial guidance and navigation systems and fly-by-wire systems used in a wide variety of military and commercial applications. After retirement from MIT in 1973, Draper continued his research activities at the Instrumentation Lab. In recognition of his outstanding achievements, Draper received numerous awards, including the National Medal of Science in 1964, the Robert H. Goddard Trophy in 1978, and the Smithsonian Institution's Langley Gold Medal in 1981.

Draper died in 1987 in Cambridge, Massachusetts. In 1988, the National Academy of Engineering established the Charles Stark Draper Prize, which is endowed by Draper Lab.

The Charles Stark Draper Prize honors people who have "contributed to the advancement of engineering and to improve public understanding of the importance of engineering and technology" or engineers "whose accomplishment has significantly impacted society by improving the quality of life, providing the ability to live freely and comfortably, and/or permitting the access to information."

Doc Draper and the MIT Instrumentation Laboratory

Some of the most significant aerospace research advances at Hanscom Field came from MIT's Instrumentation Lab, created by Charles Stark Draper in 1932. Under Draper's direction, the Instrumentation Lab, funded by MIT and the US military, quickly became the world's leading academic research center for inertial guidance technology. The Instrumentation Lab was responsible for numerous World War II and Cold War technological advances. Many of the Lab's designs were flight-tested and refined at Hangar 24 at Hanscom Field using military aircraft.

The Instrumentation Lab's first major success came in 1942 with the development of the Sperry-Draper Mark-14 gyroscopically stabilized gunsight, which dramatically improved the accuracy of anti-aircraft guns. Using some of the same principles, the Lab designed an aircraft bomb-rocket sight, which became the A-4 gunsight used on F-86 fighters during the Korean War. These gunsights laid the ground work for the Instrumentation Lab's later technologies that would be tested from Hangar 24.

In 1953, the Instrumentation Lab team developed the Space Inertial Reference Equipment (SPIRE) system. SPIRE used gyroscopic positioning and accelerometer measurements (collectively referred to as an inertial navigation system) to accurately determine an aircraft's position with no outside reference points. This was a major improvement over radar or visual guidance, as the SPIRE system was less susceptible to jamming by the enemy or the effects of bad weather. Building on SPIRE's success, Draper and his team designed the guidance systems for numerous Intercontinental Ballistic Missiles (ICBMs), including the US Navy's Polaris system for submarines, which were a significant element of the United States' Cold War defense strategy.

In 1957, after the Soviet Union launched Sputnik, the first man-made Earth satellite, Instrumentation Lab employees Hal Laning, a computer scientist, and Mit Tragesser, a mathematician, began designing a Mars probe incorporating inertial guidance technology. Although the Mars project did not come to fruition, in 1961 NASA selected Draper's team to design the guidance and navigation systems for the Project Apollo moon missions (1963–1972). NASA called on the Instrumentation Lab's expertise again for the Space Shuttle program (1981–2011).

In 1970, MIT separated from the lab, which was renamed the Charles Stark Draper Laboratory. In 1973, the lab became a non-profit corporation, Charles Stark Draper Laboratory, Inc. The Draper Lab continued to use Hangar 24 intermittently to test military and civilian technologies until 1978, when the MIT Lincoln Lab took over the building. After Hangar 24 could no longer adequately act as a research and testing facility for the Draper Lab, the group moved to a new, state-of-the-art facility at Hanscom Field.

Hangar 24 at Hanscom Field

While the Instrumentation Lab and Draper's office were headquartered on the MIT campus in Cambridge, from 1948 to 1978 they tested most of their flight technologies at the MIT Instrumentation Laboratory Flight Facility at Hanscom Field (later the Charles Stark Draper Laboratory Flight and Systems Test Facility), commonly referred to as Hangar 24. The hangar, an Army Air Force demountable, or DH-type, hangar, was designed to be easily put together or taken apart for shipment to defense installations during World War II. The steel-framed building's roof utilized a pair of arched bays connected by a gable to provide an open floor plan. Hangar 24 was originally located at Hunter Army Airfield in Georgia. At the end of its military use in 1948, the building was acquired for the Instrumentation Lab and erected in a new, convenient location on the western edge of Hanscom Field, where it provided a testing facility for the Instrumentation Lab.

In the early 1970s, when Hangar 24 no longer met Draper Lab's needs, the facility was turned over to Lincoln Laboratory and in 1978, Hangar 24 was renamed the MIT Lincoln Laboratory Flight Test Facility. Lincoln Lab tested radar and data link systems at Hangar 24, including the Traffic Alert and Collision Avoidance Systems (TCAS) that is used today by most US commercial aircraft. By the 1990s, the hangar's small size made it obsolete. Lincoln Lab vacated the hangar in 2001, after the building reached the end of its functional life and could no longer serve any research and testing function. A state-of-the-art aircraft hangar and aviation support space now occupies that location.

Defense Research at Hanscom Field

Throughout the Cold War, MIT and the US Air Force constructed multiple research facilities adjacent to Hanscom Field to support national defense. Chief among these were MIT's Lincoln Laboratory, which took over Hangar 24 in 1978, and the Air Force's Cambridge Research Laboratory (AFCRL) and Electronic Systems Division. These groups followed the same collaborative government-university model as Charles Stark Draper's Instrumentation Lab. Their influential work included the development of long-range radio and satellite communications, bulk crystal growth for microchips, and the Global Positioning System (GPS), among many other technologies. This research activity also contributed to the establishment of Route 128 in Massachusetts as "America's Technology Highway."

Lincoln Lab was born out of a joint MIT–Air Force study in 1950 that determined the need for an air defense research group. Lincoln Lab's first major project was the Semi-Automatic Ground Environment Air Defense System (SAGE) to intercept nuclear bombers. SAGE collected, analyzed, and relayed data collected by radar in real time using the Whirlwind mainframe computer. Radar research at Lincoln Lab led to the development of air traffic control systems after commercial aviation activity expanded in the late 1960s.

The Air Force founded AFCRL (now the Cambridge Research Center, or CRC) at Hanscom Field in 1950. This center built on the collaborative research of the US armed forces and Boston-area universities during World War II. Research conducted at AFCRL focused initially on weather radar, airborne electronics, air defense systems, and radio chemistry. Today, CRC's research is in the areas of solar and terrestrial weather, and space vehicles and sensors.

America's Technology Highway

Route 128 in Massachusetts is often referred to as the "Tech Belt." The highway around Boston was built from 1936 to 1959, with the portion near Hanscom Field opening in 1951. The surrounding area is home to thousands of technology companies and is constantly evolving. During World War II (1941–1945) and the Cold War (1946–1989), Hanscom Field emerged as a center of defense research and development for the military because of its proximity to the numerous universities in the greater Boston region. The Air Force's decision to base major research and development operations at Hanscom Field and to contract with civilian research groups such as MIT's Instrumentation Lab and Lincoln Lab led to a proliferation of technology companies and labs in the area. By 1955, the region west and northwest of Boston near Hanscom Field and Route 128 had a national reputation for excellence in electronics research. In 1961, 169 businesses employing 24,000 people were located along Route 128, with 29 of those companies directly connected to the MIT Instrumentation Lab. Just over a decade later, there were 1,212 companies in the area. This period of rapid regional growth in the technology industry extended into the late 1980s and was referred to as the "Massachusetts Miracle," with Route 128 dubbed "America's Technology Highway," or "America's Technology Region."

The development of the Route 128 region was a model for other major centers of technological innovation including Silicon Valley. Today, the region continues as a center of scientific research and development for military and civilian applications.

For more information about Hangar 24 and Hanscom Field, visit www.massport.com